

Retrieval of Optical Properties of Rutile from Emittance Measurements

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Titanium dioxide, especially the rutile phase, is widely used in thin film coating applications. Furthermore, it is also responsible for the high corrosion resistance of the Ti-6Al-4V alloy, which covers more than 50% of the industrial applications of titanium alloys. Thus, on the one hand, the optical properties of the rutile have to be taken into account when studying the radiative behaviour of the Ti-6Al-4V in working conditions, and in the other hand, their knowledge allows improving the design capabilities of thin film coatings. In this work, the normal spectral emittance of the rutile phase was measured for both polarizations, perpendicular and parallel to the tetragonal axis. The measurements were carried out using two Fourier Transform Infrared (FT-IR) spectrometers, a Vertex 70 and a Vertex 80V, between 40 and 11200 cm⁻¹, and from 500 to 2000 K. The emittance spectra show a strong temperature and wavenumber dependence, which is represented by a strengthening and broadening of emission bands in the opaque zone and a large increase of the rather flat electronic contribution appearing in the semi-transparent region as the temperature rises, leading to nearly black body behaviour at high temperatures. The retrieval of the optical functions of the rutile was obtained by fitting the experimental data with a dielectric function model. Finally, all these results will be compared and discussed with the ones available in the literature.